Physics Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

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CHAPTER 4

Motion in Two Dimensions

Projectile motion

TIME, HEIGHT, RANGE

$$T = \frac{2u\sin\theta}{g}, \qquad H = \frac{u^2\sin^2\theta}{2g}, \qquad R = \frac{u^2\sin 2\theta}{g}$$

MAXIMUM RANGE

$$R_{\max} = \frac{u^2}{g} \text{ at } \theta = 45^\circ; \qquad \theta \text{ and } 90^\circ - \theta \text{ give the same range}$$

TRAJECTORY

$$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta} = x\tan\theta\left(1 - \frac{x}{R}\right)$$

$$\tan\theta = \frac{4H}{R}$$

ON AN INCLINE (ANGLE A, THROWN AT Θ TO IT)

$$T = \frac{2u\sin\theta}{g\cos\alpha}, \qquad R_{\max} = \frac{u^2}{g(1+\sin\alpha)} \text{ up the incline}$$

Relative motion and river crossing

RELATIVE VELOCITY

$$\vec{v}_{AB} = \vec{v}_A - \vec{v}_B$$

SHORTEST TIME

$$t = \frac{d}{v_b} \text{ (head straight across)}, \qquad \text{drift} = \frac{v_r d}{v_b}$$

SHORTEST PATH

$$\sin\theta = \frac{v_r}{v_b} \text{ (upstream)}, \qquad t = \frac{d}{\sqrt{v_b^2 - v_r^2}}$$

RAIN–MAN

$$\vec{v}_{\text{rain, man}} = \vec{v}_{\text{rain}} - \vec{v}_{\text{man}}$$

Hold the umbrella along the relative velocity of rain.

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